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PROGRESS
THE NATIONAL TOOL AND DIE JOURNAL

TOOLS, DIES, JIGS, FIXTURES, MOULDS, GAGES, MACHINES
Design and Engineering
PRECISION SPECIALTIES
STAMPING and PARTS PRODUCTION
Official Publication
Special Tool, Die & Machine Shop Industry

JUNE
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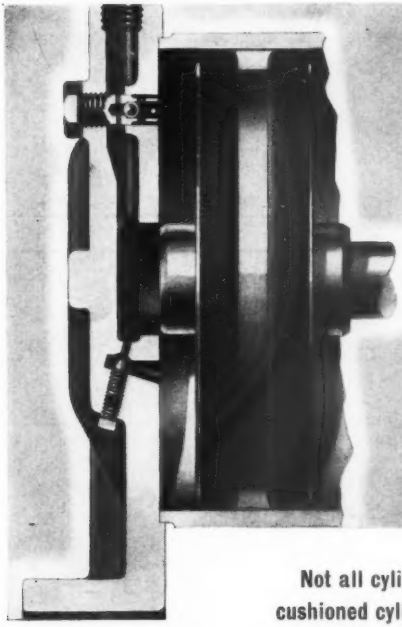

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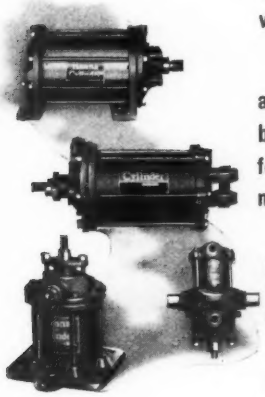

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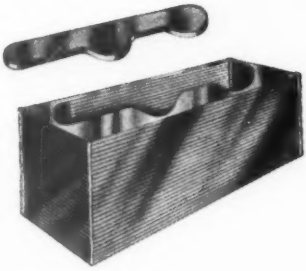

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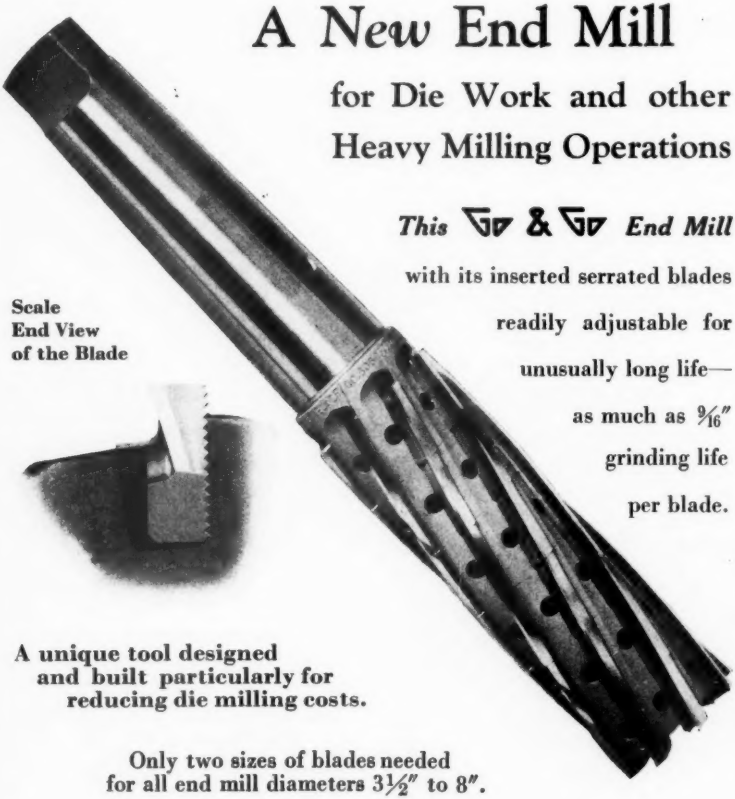

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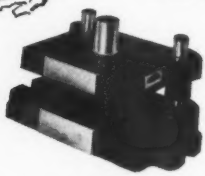

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8

Tool • Die • Machine **PROGRESS**

The National Tool and Die Journal

June, 1939 **Vol. 5, No. 3**

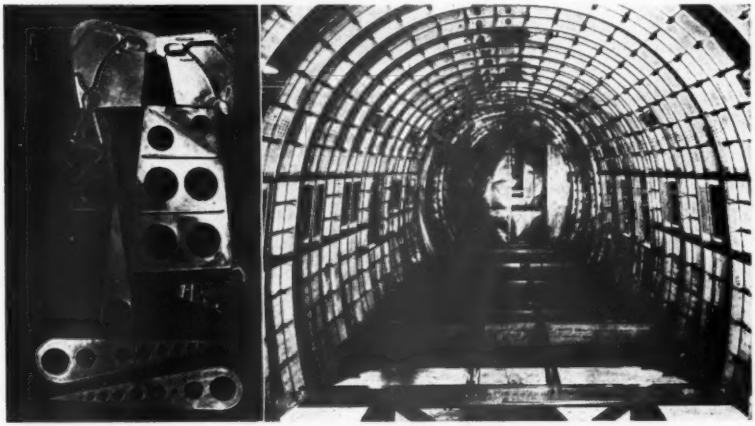
The Utilization of Rubber in the Fabrication of Plane Stampings

By George A. Strompl
Production Manager
Douglas Aircraft Company, Inc.

THE fabrication of thousands of intricate metal stampings that go into modern aircraft has presented a major problem to aircraft designers and builders. The extreme demands for strength, lightness, accuracy to size, contour and intricate shapes, have made hand fabrication slow and costly. For example, at least 3,000 parts of Duralumin from .003″ to .125″ in thickness are assembled in Douglas Transports.

Duralumin is the lightest yet sturdiest metal available to the aircraft manufacturer at the present time. Wing and cabin covering, reinforcing ribs, bulk-

(Continued on Page 18)



Left—Parts of Duralumin fabricated by the Guerin Process illustrate newest aircraft design for strength and lightness. Right—cabin covering, ribs, floor frames, bulkhead and other parts in the basic structure of this Transport cabin indicate how dependent modern planes are on blanking and forming dies.

Ingenuity of Design, Accuracy of Construction Determine Value of Jigs, Fixtures and Gages

By L. A. Sommer, President
The Sommer & Adams Company

JIGS, fixtures and gages are among the most important of production tooling devices because they have contributed so greatly to increased manufacturing efficiency and reduction of product cost. The insistent demand for more economical methods is making modernization of tooling facilities an ever-increasing necessity.

It is only a comparatively few years ago, even in the modern automobile industry, that hand-work was required and allowed for, because the facilities of the day were not adequate to deliver the degree of product accuracy required for perfection in assembly. Production plants provided for this final fitting of parts by hand filing and scraping as a necessity.

Today's production methods almost eliminate this hand-work and mechanical processes turn out a product more accurately and much less expensively than any hand-work ever could. Think of the savings which have been realized by eliminating such hand fitting and selective assembly which were really just a method of trying and fitting—trying until a fit was found or a fit was made by hand filing.

Jigs, fixtures and gages play an exceedingly important part in these improved methods and are outstanding examples of special tooling and accessories employed not only to achieve the degree of accuracy which makes hand fitting unnecessary but which also makes parts interchangeable.

It is the general opinion today among the users of every kind of mechanical product and equipment from the individual who owns an automobile to the manufacturer who uses machine tools to fabricate its parts, that it should be pos-

Fig. 1, Left—An ordinary holding fixture of simple V clamp design used in the milling of a slide base. Partial machining is done with "gang cutters" and a finishing operation with a dove-tail cutter.

Fig. 2, Right—Two holding fixtures are mounted on the twin-table. An interlocking cutter mills the part in one fixture while the operator loads the other.

sible, if a breakdown occurs, to order a replacement part which is so identical with the broken one that it fits perfectly into the assembly without the necessity for much effort on the part of a mechanic. Such interchangeability of manufactured parts can be accomplished only with the use of equipment which functions as accurately as do correctly designed jigs, fixtures and gages.

Fig. 3, Left—A universal jig with interchangeable index and bushing plate in use drilling cam drums. The ingenuity of this design made it possible to replace a large number of jigs formerly required.

Fig. 4, Right—An index fixture holds a tool slide for surface grinding. The index is provided with bushings which must maintain an accuracy of .0005". To do this the index pin which locks the tool slide in position must be ground and lapped to a "wring" fit.

Jigs and fixtures are so generally mentioned together that the differences between them should be defined. In the language of the shop man a fixture is a device for holding or clamping a part or product while it is being machined or assembled. It is usually attached to and made a part of the machine tool or other equipment with which it is used. Ordinarily its position is not intended to change.

Not only must a fixture hold the part or product rigidly and accurately so that it will be machined perfectly as an individual piece, but it must maintain that accuracy so that as the part progresses from one fixture to another in the successive steps of its manufacture, it will be interchangeable with every other similar part.

A jig, on the other hand, is a device which may be said to enter more directly into the actual processing operation. It usually functions as a precision guide for the tool which is used in the operation, thus there are drilling and reaming jigs. Jigs are frequently more complicated than fixtures because they may have movable and replaceable parts although both jigs and fixtures are often built with indexing plates.

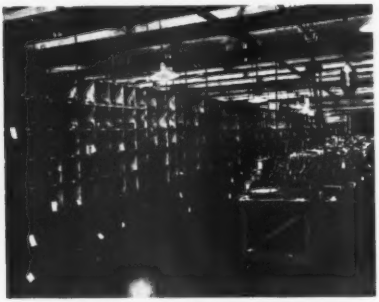
It is hardly necessary to define a gage. It may be considered briefly as a device used for determining the similarity of a dimension or contour in relation to one of a similar part or one in which it is intended to function. A gage measures the degree of accuracy which has been attained in a machining operation.

Two Qualities Determine Value

Two specific qualities determine the value of a jig or fixture. The first one is unquestionably correctness of design, the second, accuracy of manufacture. It is frequently the ingenuity of the design of a jig or fixture which determines its greatest value in production. A jig or fixture should always operate to reduce the cost of handling or machining a part or both. As an example, a fixture, which does not permit loading or unloading easily, defeats the first purpose for which it is intended and what is more, a well designed jig or fixture always permits the employment of an ordinary machine operator instead of a more highly skilled worker. Both jigs and fixtures reduce the time for machine setups because they are production devices handled as units

—they eliminate the detail of complicated setups which can usually be made only by skilled operators.

After a jig or fixture has been correctly designed it must be accurately built. The best obtainable steels, castings and parts are never too good for a jig or fixture upon which precision production depends. Parts should be ground and lapped and construction generally should be so perfect that the product cannot move nor its alignment be altered to even the slightest extent. To make handling easier and to lessen operator fatigue, jigs and fixtures should be built as light as possible but without sacrificing rigidity.



One section of the jig room where the "mechanical hands" of a production plant are stored. A specified operation sequence gives the maximum service and minimum down time on jigs and fixtures in this plant.

Best Tools Cost Less

If there are still manufacturers who only partially realize the value of a well designed and carefully built jig or fixture and who, looking upon them as necessary evils, buy on merely a price basis, let them consider the comparatively small difference between the original cost of such a device built to a price and one which has been carefully designed and built of the best materials obtainable. In the first instance there is ever present the possibility of product inaccuracies, as well as the lowering of the production rate. Both contribute to increased product cost. On the other hand the perfect performance of the well built jig or fixture not only guarantees the continuous accuracy required but also its longer use life reduces the necessity for replacement as a whole or in part.

One of the many manufacturers who have given intelligent consideration to the advantages of special jigs and fixtures is the National Acme Company, builders of Acme Gridley Automatic Screw Machines. This company has found it profitable to use hundreds of special jigs and fixtures in the operations which are necessary from rough castings to finished machines. The parts production department, machine rebuilding department, as well as the tool room, use additional scores of setups, most of which employ special jigs and fixtures. A view of the company's jigs and fixture room accompanies this article.

The use of more jigs and fixtures in manufacturing can have a decidedly beneficial effect upon the employment of unskilled and semi-skilled workers who are so largely in the majority today. By its very nature every such device is designed to release skilled workers of whom a shortage develops every time there is a spurt in business activity and to make it possible for less skilled operators to carry on with the same degree of accurate production.

Precision jigs, fixtures and gages are vitally important to the production manufacturer. This will be acknowledged more generally as designs improve and there develops the appreciation that the same degree of precision should prevail as with special machines and other fine production equipment. By count there are comparatively few men and shops who may be said to specialize in this branch of precision tool building. Some production manufacturers do frequently design jigs and fixtures which they use, but it is a notable fact that those contract tool shops who specialize in these products are generally recognized and called in to assist in solving the more intricate of these tooling problems.

Die Designing and Estimating

Advanced Series

VI

By GEORGE DANNES

George Dannes is superintendent and engineer of the Raffel Manufacturing Company of Chicago, and instructor in the advanced class studying Die Designing and Estimating at the Carl Schurz High School under the auspices of the Chicago District of the Special Tool, Die and Machine Shop Institute.

This is the sixth installment describing the Dannes method for accurately predetermining die costs. The method employs ingeniously developed time values which enable the estimator to reinforce his judgment with a practical system which eliminates much guesswork. Succeeding installments will continue to be of extraordinary value to die builders and users.—The Editor.

ESTIMATING THE FINISHING OF CLOSED DIE OPENINGS, PUNCHES, PADS, STRIPPERS AND SHOES

FINISHING the die opening is logically the next work to be done and Fig. 15 is the table of values to be used in estimating the time required. It is always to be used in conjunction with the table of die block thicknesses, Fig. 14, in the previous chapter. While the time values in the latter are based upon die block thicknesses and the number of units of which die openings are composed and their respective sizes, it will be noted that Table 15 used in this chapter bases its values upon the dimensional tolerances specified and naturally also upon construction units and sizes of openings. All values in Fig. 15 are likewise based on a die block thickness of 1" and each represents the actual time consumed in filing, stoning, lapping, grinding, etc., to bring a die opening to that state where it will produce the stamped part accurately according to blueprint specifications. There is a sharp increase in time as the tolerance becomes closer, which is obvious, because so much more care and skill are required to work to one one-thousandth of an inch as compared with five one-thousandths which is considered only a commercial tolerance.

We are ready now to estimate the time required to finish the opening of the specimen die which we are building to blank out our product part which has a contour measurement or size of 4" and a unit value of 4. Our tolerance specification is ± .002" (Fig. 1, page 15, February issue—also reproduced on page 19, April issue) and on the square where these three meet, Table 15, indicates that the time required will be 1.6 hours. (Move to group 4" in top or size line, select 4 unit column and drop to specified tolerance of ± .002"). Make

Time Values for Finishing Dies

FIG. 15

SIZE		.5″				1″				2″				4″				8″				12″				16″				TIME IN HOURS
UNITS		4	8	12	16	4	8	12	16	4	8	12	16	4	8	12	16	4	8	12	16	4	8	12	16	4	8	12	16	
TOLERANCE	±.005″	.4	.5	.9		.4	.6	1.2	1.8	.4	.5	1.0	1.4	.4	.6	.9	1.1	.5	.8	1.0	1.2	.6	1.0	1.2	1.6	.6	1.1	1.4	1.7	
	+.004″	.8	1.0	1.8		.8	1.2	2.4	3.6	.8	1.0	2.0	1.8	.8	1.2	1.8	2.2	1.0	1.6	2.0	2.4	1.2	2.0	2.4	3.2	1.2	2.2	2.8	3.4	
	+.0025″	1.2	1.5	2.7		1.2	1.8	3.6	5.4	1.2	1.5	3.0	4.2	1.2	1.8	2.7	3.3	1.5	2.4	3.0	3.6	1.8	3.0	3.6	4.8	1.8	3.3	4.2	5.1	
	+.002″	1.6	2.0	3.6		1.6	2.4	4.8	7.2	1.6	2.0	4.0	5.6	1.6	2.4	3.6	4.4	2.0	3.2	4.0	4.8	2.4	4.0	4.8	6.4	2.4	4.4	5.6	7.8	
	±.0015″	2.4	3.0	5.4		2.4	3.6	7.2	10.8	2.4	3.0	6.0	8.4	2.4	3.6	5.4	6.6	3.0	4.8	6.0	7.2	3.6	6.0	7.2	9.6	3.6	6.6	8.4	10.2	
	+.001″	3.2	4.0	7.2		3.2	4.8	9.6	14.4	3.2	4.0	8.0	11.2	3.2	4.8	7.2	7.7	4.0	6.4	8.0	9.6	4.8	8.0	9.6	12.8	4.8	8.8	11.2	13.6	

Time Values for Finishing Die Parts

FIG. 16

		TYPE 1 PUNCHES SHEDDERS ARBORS ETC.				TYPE 2 PUNCHES ARBORS ETC.				TYPE 2 SHEDDERS				OPENINGS IN PUNCH PAD DIE SHOE				OPENINGS IN STRIPPER				DRILL ROD PUNCHES				OPENINGS IN SHEDDER				TIME IN HOURS
UNITS		4	8	12	16	4	8	12	16	4	8	12	16	4	8	12	16	4	8	12	16	4	8	12	16	4	8	12	16	
SIZE	.5″	2	3	5						3	5	10		.8	.8	.8	.8	.5	.5	.5		2.5	3.2	5.7	6.7	1.5	2.5	5		
	1″	2	3	6	8					4	6	12	16	.8	.8	.8	.8	.8	1.2	2.4	3.2	2.9	3.9	6.9	8.9	2	3	6	8	
	2″	2.8	3.5	7	9.8	4.8	6	12	16.8	4	5	10	14	1.2	1.5	3.0	4.2	.8	1.0	2.0	2.8					2	3	5	7	
	4″	2.8	4.2	6.3	7.7	4.8	6	10.8	13.2	4	6	9	11	1.2	1.8	2.7	3.3	.8	1.2	1.8	2.2					2	3	5	7	
	8″	3.5	5.6	7	8.4	6	9.6	12	14.4	5	8	10	12	1.5	2.4	3.0	3.6	1.0	1.6	2.0	2.4					3	3	4	5	
	12″	4.2	7	8.4	10.2	7.2	12	14.4	19.2	6	10	12	16	1.8	3.0	3.6	4.8	1.2	2.0	2.4	3.2					3	4	5	6	
	16″	4.2	7.7	9.8	11.9	7.2	13.2	16.8	20.4	6	11	14	17	1.8	3.3	4.2	5.1	1.2	2.2	2.8	3.4					3	5	7	8	

a record of this on the Estimating Sheet (Fig. 5) in the same space with the 4.0 hours for "roughing out" the die opening. Do not add them because each time value should be immediately available for further reference.

Fig. 16 is the table for determining the time values for finishing other die parts —punches, shedders, pads, arbors, etc. Its application is no more difficult than the previous ones. There are the familiar divisions of sizes (vertical) and units (horizontal) for each of the parts which are required for most dies. The figures under each of the seven vertical column headings indicate in hours the time required for completely finishing the indicated parts whose sizes and contour characteristics expressed in units have been previously determined.

MACHINE OPERATIONS

ALL DIE PARTS	A	B	C	D	E	F
DIE	.6 .8	.7	.4	1.6 4.0		
PUNCH	.3 .5			2.8		
PUNCH PLATE	.4 .3	.7		1.2		
STRIPPER	.4 .3	.7		.8 1.0		
DIE SHOE		.7		1.2		
PUNCH HOLDER		.7				
STOP						
INSPECTION			1.9			
TRYOUT						
TOTAL	3.6	3.5	2.3	12.6		

Data of Group A from March, of Group B and C from April issues.

4.0 hours opposite "Die" in Column D for rough machining the die opening is from the May issue.

ESTIMATING SHEET
Fig. 5

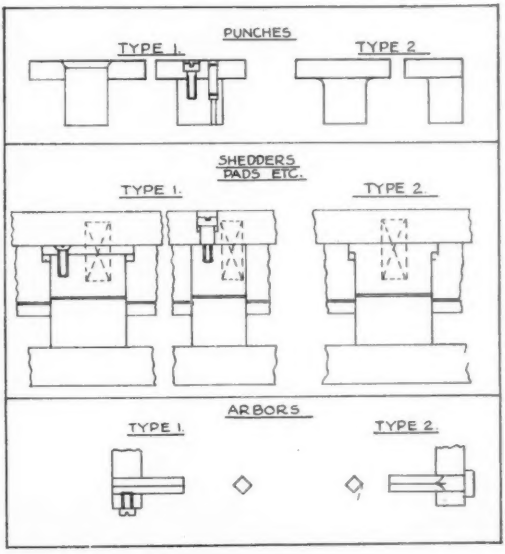


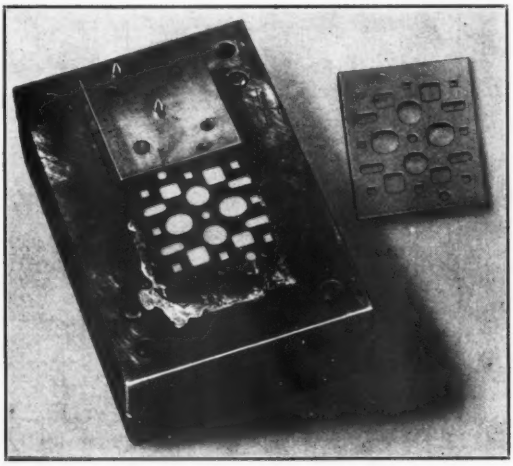
Fig. 17

The two basic types of the die parts for which Table 16 is intended are illustrated in Fig. 17. A comparison of their construction readily suggests that more time is required in each instance to machine Type 2 than Type 1. Time values for Type 1 are in the first column, for Type 2 in the second column.

In the third column shedders of Type 2 are considered separately because this type is generally used in compound dies where contours are irregular and a shoulder is required on the bottom to hold the shedder in the die. The fourth column presents time values for finishing punch plate (pad) openings for mounting Type 1 punches, also openings in the die shoe to permit slugs to pass through.

(Continued on Page 28)

The Use of Matrix to Reduce Die Making Costs



By
J. R. Fitzsimmons
President,
Die Supply Co.

A group of punches held in accurate alignment by matrix. Matrix is easy to use and two to two hundred hours production time can be saved.

IN making metal-working dies, the traditional "fitting-and-filing" practice of locating punch and die parts is rapidly giving ground to the more modern matrix method in regular production. Die costs have such a substantial influence on the price for which an article may be sold in many cases, that in the highly competitive markets of the present it is necessary for the manufacturer to reduce production costs wherever possible.

No complicated holding devices are required in securing punch and die parts by means of matrix. This material permits the fast, accurate alignment of punches with relation to dies without the need of machining non-working surfaces to close dimensions. Savings of two to two hundred hours production time are common in making dies. It is recommended that complicated dies be made in easily machined sections, which are then readily mounted in matrix. The result is not only a saving in time but also the prevention of the occasional heavy loss sustained when a one-piece die cracks or warps in hardening or later in operation. While savings in the making of such dies by the matrix method are most pronounced, they are also well worth while in smaller, less complicated dies.

One advantage of the use of matrix is the fact that, although the matrix permanently holds each piece in place, any part may be removed at will by applying a little localized heat to the matrix. The melting temperature of the matrix* offered by a well known concern is 248° F. This, of course, is safely below the temperature that would begin to draw the hardness of the die. The pouring temperature in setting die and punch parts is 300-350° F. Freezing range is 260-216° F. It can be handled with a trowel or spoon within this range. This matrix has a tensile strength of 13,000 lbs. per sq. in., Brinell hardness of 19 and an elongation of less than one percent. The alloy is hard enough to hold punches permanently and has the unique property of expanding slightly upon solidifying. Expansion is approximately .002 in. per inch. Those shops that use the matrix method do not seem to regard it as a makeshift. In

(Continued on Page 40)

*Cerromatrix—furnished by Die Supply Co., Cleveland. (Produced by Cerro de Pasco Copper Corp.)

They Ask For No Medals . .

MANY of the most important contributions to the precision production methods of today have been made by the members of THE CONTRACT TOOL-DIE-MACHINE INDUSTRY.

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An Advertisement of the

SPECIAL TOOL, DIE AND MACHINE SHOP INSTITUTE

When you order or write about products described in TDM PROGRESS please mention the publication.

Utilization of Rubber

(Continued from Page 9)

heads, braces, fairings, baffles, floor frames, wing beams and gas tank frames are among the principal parts fabricated of this metal. The problem of simplifying the manufacture of these parts was of primary importance. Considerable thought was devoted to the question.

The question "How could these parts be made more economical and with uniformity?" was followed by "And why not use an hydraulic press?" Then the problem of die costs arose. Plane building was not a mass production problem. Only a few parts were required at one time. The die costs would have been prohibitive. Yet the obvious advantages of the hydraulic press were not forgotten. Experiments and developments in temporary blanking and forming dies using case hardened rolled steel, hard wood faced with steel, zinc and aluminum were made. Rubber was found to be the most satisfactory material for the pressing block, since it forced the Duralumin into the dies at high pressure forming parts smoothly and without wrinkles.

Out of this research came the Guerin Process, a procedure utilizing live rubber in conjunction with forms of negligible cost.

The block of rubber used is of particularly high grade compound for resisting cutting and abrasion. It is also a compound of extremely high elongation properties in order not to tear through the deep drawing-forming operations.

Rubber used in this operation has been developed by The Goodyear Tire & Rubber Company in cooperation with the Douglas Aircraft Company.

Since even the smallest hydraulic press was too costly for producing one piece at a time, it was a logical step to the use of a larger pressing area to shape a number of different sizes of parts at one time. A H-P-M Hydro-Power Fastraverse Press of 2,000 tons pressure capacity was selected and installed. Installed in 1935 this press is the vertical, downward acting type with a closed top, pedestal type of bed. The platen is actuated by a single acting ram and two single acting pullback rams.

Numerous sheets of Duralumin were

(Continued on Page 30)

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Our facilities have been built toward one goal — the finest workmanship.

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The Salt Bath Method of Steel Treating

The Sal-Way method for heat treating tools, dies and all steel products employs a series of immersions in salt baths. The furnaces are both electrically heated and controlled. The combination is said to bring to steel treating a higher degree of accuracy and a greater assurance of uniformity part for part. The fact that no scale results and that there is a minimum of distortion recommends the process particularly for the precision hardening of tools. It is equally effective for all types of steels, particularly valuable for high speed and when used on Molybdenum steels it leaves no soft skin.

Sal-Way Steel Treating, Inc., uses this salt bath method exclusively and has developed its business nationally. The illustration herewith shows a battery of four of its furnaces operating at varying temperatures. There is complete submersion in the salt after which the hardened pieces are cooled in still air and followed by reheating. A shot blasting chamber is used for finishing the tools or parts.

Salvaniting is a Sal-Way process applied to finished tools to increase their cutting efficiency and life. It increases wear-resistance without making the tool brittle and records indicate longer life varying from 25 to 200 per cent depending upon the type of tool which has been so treated.

For further information write Sal-Way Steel Treating, Inc., 624 West Elizabeth Street, Detroit, Michigan.

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- ACME Leader Pins and Bushings, and Dowel Pins maintain the same standards of accuracy.

- We also specialize in complete machine part manufacture requiring extremely close limits, lapped fits, etc., for pressures up to 20,000 pounds per square inch.

- Send for complete catalog or specific data sheets.

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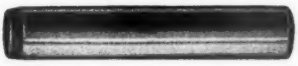

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206 No. Laflin Street Chicago, Illinois

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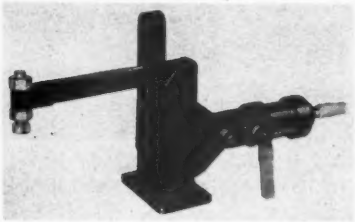
Detroit Stamping Markets Air-Actuated Toggle Clamp

THIS new model De-Sta-Co Toggle Clamp, with built-in air cylinder, has just been placed on the market.



Attached to the air line and operated with a Ross Air Control Valve, this new clamp is said to be particularly useful on fixtures requiring multiple clamping operations, as for holding large sheet metal panels, wherein one air valve can be made to control and operate several of these De-Sta-Co clamps. May also be used for clamping operations in inaccessible places. It is said that these new air operated toggle clamps offer a speed far in excess of that obtainable with hand-operated clamps as used for drilling, reaming, welding or assembly operations.

Descriptive circular has been prepared and will be sent free on request. Address Detroit Stamping Co., 3443 Fort St., West, Detroit, Mich.

Continental Introduces Saw Carton

THE DOALL Precision Saw Carton, a container which provides a means of handling and dispensing a coil of metal band saw is announced by Continental Machines, Inc., as a new and original method of narrow blade band saw packaging.

A unique feature of the DOALL Precision Saw Carton is the opening in one corner, which permits stripping of the required saw length from the box, keeping the remainder intact. The shop or stock man inserts the outer coil end through the slot provided; the saw is then cut off as needed. All DOALL Precision saw blades in 100-foot coils

What Would You Do?

the Punch Press Foreman reports a Broken Die. He cannot make Shipments:

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This is what he did. He sent for DARWIN'S *Welding Rods* for PRECISION WELDING and immediately repaired the Die with a Self-Hard Welding Rod, specially adapted for his Base Metal.

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or larger are packed in this attractive blue and white box. Printed on the container is a list of all DOALL CONTOUR SHAPING MACHINES showing the correct saw length for each machine. Every carton is individually marked to indicate the exact specifications of the saw it contains.

The cellophane covered window enables the shop man to determine the amount of saw remaining in the box.

Of approximately 300 different types and sizes of Precision narrow blade band saws available, a substantial stock of over 200 is maintained by Continental Machines for immediate delivery. For customer protection, the Company has an elaborate Experimental Department, wherein all band saw material is thoroughly tested before being placed in stock. Major parts of the test include stretching and flexing tests, chip construction and tests on cutting speeds and saw life. All DOALL Precision narrow blade saws are unconditionally guaranteed.

The new carton provides for saw storage in a minimum space with maximum convenience. The cartons can be stocked in the DOALL Storage Cabinet according to type of saw, facilitating quick, accurate inventory.

Literature giving specifications of DOALL Precision Saw Blades and DOALL Storage Cabinet will be sent on request. Ask also for catalog on DOALL CONTOUR SHAPING MACHINES. Write Continental Machines, Inc., 1303 S. Washington Ave., Minneapolis, Minn.

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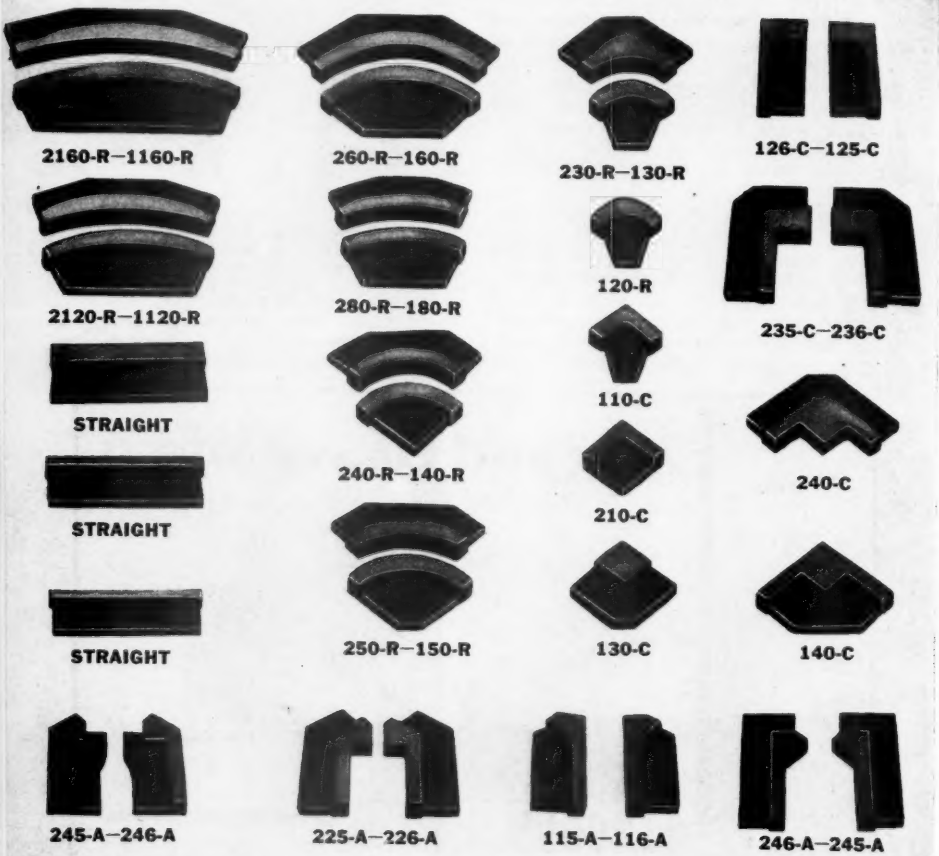

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DIE SHAPES

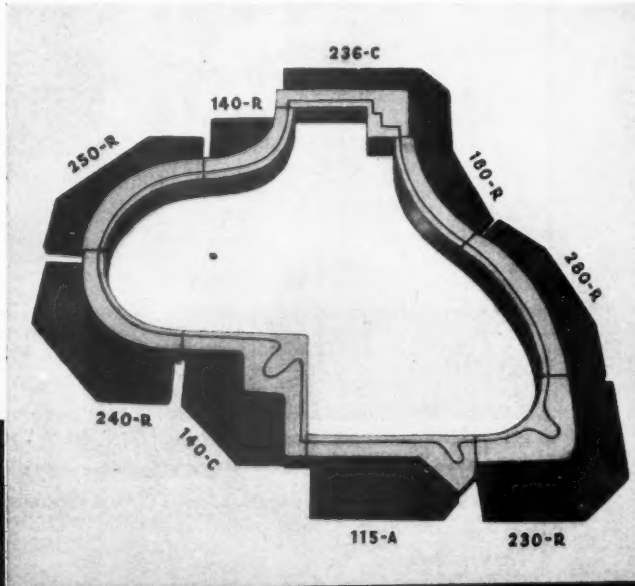
35 STANDARD SECTIONS

NOW YOU CAN *Save* 18% to 47% on DIE COSTS!

Think of it, a savings for you from 18% to 47% on die costs, because FCC has devised 35 standard composite steel die sections to make it easier for you to get in production quicker! These sections are made of tool steel* electrically welded by special process to an easily-worked base of SAE 1020, from which you can make any die you need for blanking regular or irregular shapes from sheet metal. Prepare now to reap your full benefit from this remarkable advance in die making—write today for blueprints and complete information.

• • • • and HERE is HOW *Easily* it's DONE

First you select the proper sections from the blueprints of the 35 sections with your design—then order by number—it is as quick and easy as that. To illustrate this more graphically we show a photo to the left with all 35 die shapes numbered, and below is a die that has been constructed from nine of these 35 standard sections. You will readily see from this how easy it is to construct dies the new FCC way with the minimum amount of machine work and why you realize definite savings in using them.



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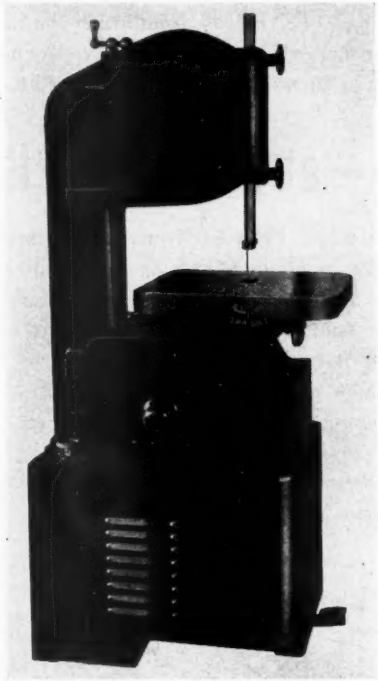
Grob Brothers Design New Open End Band Saw

A NEW Open End Band Saw, designated as Model OS-14, has been placed on the market by Grob Brothers, well known manufacturers of die making machines. This machine is designed for sawing out of medium and small sized dies, punches, stripper plates and miscellaneous parts.

Many advantages of this type of machine over the conventional type, using a welded blade, are outstanding. They include, besides instant internal sawing, smooth cutting action at all times, and also a positive drive to the blade. Since a welded portion of the blade is at no



time passed through the work, smooth, clean cutting action is assured, making it possible to saw close to a line, and, a feature even more important, to use the blade as a notching tool or as a file, since there is no welded joint to damage the sharp cutting edge of the die. By

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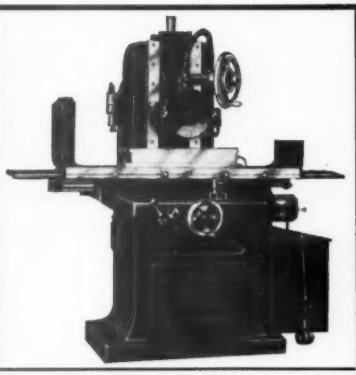
using the blade as if it were a file, small intricate dies can be finished within .001"-.002" to the line in a fraction of the time required using other methods.

The positive drive to the saw blade is also a great advantage. A friction drive uses a good part of the tensile strength of narrow blades. On the open end type machine, the upper guide wheel places very little tension on the blade, just enough to keep it from being loose, so that the entire strength of the blade is used for sawing purposes.

The set-up for internal sawing requires only 15 seconds. With equal ease the blade is removed from one opening into another, ready for sawing. The machine has a 14" throat and accommodates saw blades $\frac{1}{16}$", $\frac{3}{32}$" and $\frac{1}{8}$" wide. Saw blades 150' long are wound helically on a drum which has a threaded groove.

The base of the machine is of welded steel construction; the column and table assembly is of cast iron. The table tilts four ways and measures 20"x20". The push button to operate the machine is in convenient reach of the operator.

For further information, including the name of your nearest dealer, write Grob Brothers, Grafton, Wis.



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Sizes from 6"x10"x18" to 30"x25"x144"

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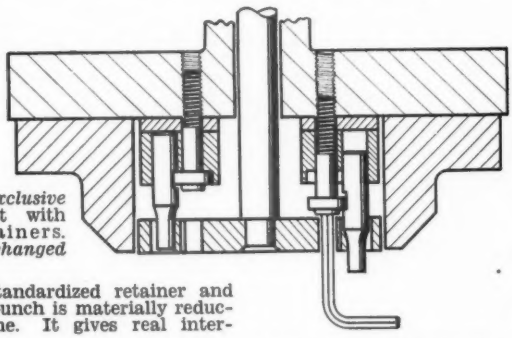

This is the new and *exclusive* advantage you now get with Hovis Screwlock Retainers. *Punches can actually be changed in one minute!*

The Hovis System of standardized retainer and quickly interchangeable punch is materially reducing punch changing time. It gives real interchangeability.

Let our engineers analyze your difficult problems and make suitable recommendations.

Left—Punch locked in place with screw head

Right—Punch being jacked out of retainer by screw head

HOVIS SCREWLOCK CO.

3129 Larned Street East -:- Detroit, Michigan

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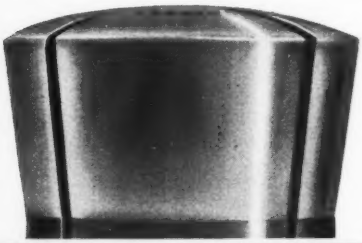

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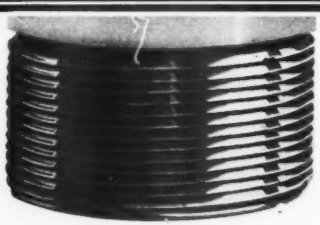

Goddard & Goddard Catalog "Tools That Go and Go"

Under the catalog heading "Tools That Go and Go," the Goddard & Goddard Company of Detroit, Michigan, describe their varied line of standard and special milling cutters, reamers, hollow mills, thread hobs and hack saw cutters.

Having concentrated upon milling cutter practice Goddard & Goddard have developed cutting tools for almost an endless variety of milling applications. The catalog is divided into seven sections as follows: Standard Milling Cutters, Inserted Tooth Cutters, Railroad Type Cutters, Expansion Reamers and Hollow Mills, Thread Hobs and Hack Saw Cutters, Special Tools, Miscellaneous Information. The company's serrated blade, cam lock construction is carefully described. Among its features are quick action and accurate adjustment; maximum expansion life of blades and a low replacement cost.

For production-planning executives the section which has to do with information on milling practice and maintenance of cutters is invaluable. Included are climb cutting; high speed milling cutter speed and feed determinations; correct practice for the grinding of forming cutters; profile cutters. Likewise there are numerous pertinent pointers which if carefully followed cannot help but assure better milling.

For a copy of "Tools That Go and Go" write Goddard & Goddard Company, Detroit, Michigan, for Catalog D.

Modern Collet Introduces Boring Mill Set

A COMPLETE set of boring mill bars and adaptors known as the Modern Quick-Change Boring Mill Set has recently been added to their established lines by Modern Collet and Machine Company. The set is assembled in a sturdy box of a convenient size for use on a work bench next to the machine.

This new Modern Quick-Change Boring Mill Set has been designed to improve boring mill operation in many ways. Once a boring bar has been set to bore a hole, it may be removed from the holder and replaced in exactly the

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same position, thereby assuring accurate diameters and depth of holes without exhaustive checking. End cutting, side cutting or shear cutting tools cannot work out, pull out, or in any way change position during cutting operations, making possible accurate milling and facing and avoidance of spoilage. Tool bit holes are at right angles to the bars so that spotfaced bosses are secured with a straight tool without any concave or convex variations. This set will efficiently operate up to an eight-inch face mill, and still retain all the quick-change features. To the manufacturer's knowledge, this is the only boring mill set which offers all of these advantages.

All boring bars or adaptors in this set can be interchanged in the chuck in approximately five seconds. All of the tools offer the rigidity necessary for the finest work. The main holder and all parts subject to axial and/or radial strains are made of the highest grade alloy steels and tempered to withstand severe shock loads. This equipment is readily adaptable to either boring or milling machines.

Descriptive material on the Modern Quick-Change Boring Mill Set is yours for the asking. Write Modern Collet and Machine Company, 407 Salliotte St., Ecorse, Mich.

100% Controlled Tool Steel

"Controlled" tool steel is simply tool steel made by controlled processes. Controls include, in addition to standard chemical and metallurgical tests, the full use of time, temperature and atmosphere apparatus in the manufacturing process. "Controlled 100%" means that every known control is used.

The buyers of tool steel not only demand the highest standard but also that such a standard be duplicated consistently. The difficulties formerly encountered in tool rooms and die shops that resulted from failure to duplicate previous tool steel lots precisely can largely be eliminated. In spite of the fact that surprising accuracy was achieved by the older "eye-and-judgment" control methods, the step-up to 100% scientific and automatic controls

(Continued on Page 35)

HIGH SPEED PROFILE GRINDING

At Lower Costs

Work that used to take *hours* is now done in *minutes*. You can now do fast, accurate grinding and fitting of profiles, difficult contours, odd shapes and uneven surfaces that under the ordinary methods of hand filing and stoning take so many tedious and costly hours. It is easier for workmen to do work of this kind with a Boyar-Schultz Profile Grinder . . . and you can always be sure of a better job.

The BOYAR-SCHULTZ HEAVY DUTY PROFILE GRINDER NO. 2, with the new Multi-Purpose Head, is a smooth running machine tool "made-to-order" for tool and die work of larger and more difficult types. All controls are located to operate conveniently from the front. Large table tilts 10°. Two H. P. ball bearing G. E. Motor turns spindle at approximately 10,000 R. P. M. with vertical oscillations of 100 per minute.

HEAVY DUTY
Profile Grinder No. 2

Portable
Profile Grinder
No. 1

Hundreds of Tool and Die Shops and Special Machine Shops have solved their contour grinding problems with BOYAR-SCHULTZ PORTABLE PROFILE GRINDER NO. 1. It is a TIME SAVER for shops with work that requires grinding and fitting to close limits. Operates at approximately 20,000 R. P. M.

WRITE FOR CIRCULARS AND COMPLETE DESCRIPTIONS

BOYAR-SCHULTZ CORPORATION
2112 Walnut Street CHICAGO, ILLINOIS

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Die Designing and Estimating

(Continued from Page 15)

In column five we find time values for openings in strippers which are clearance holes of irregular outline similar to the die opening and made to permit the punch to pass through. Column six presents values for punches which are of such small size that their working ends can be machined from pieces of drill rod. Note that the sizes of this type of punch do not exceed 1" in perimeter.

In column seven we have values for openings in shedders or pressure pads which are again clearance holes of irregular outline to permit free movement of punches mounted in them as in a compound die.

All these parts will be gone into more thoroughly in a later chapter when we will estimate a die which is composed of most of them. For the time being we make use of the data accumulated.

In our estimating form we have recorded the time for both rough machining and finishing the die opening. The next item is the punch and it is of Type 1 construction. (Fig. 3, page 16, February issue, and distinction as made in text on same page). According to the table, Fig. 16, the time required for completely machining and finishing such a punch—size 4" and units 4—is 2.8 hours. Enter the figure opposite Punch in Column D of the Estimating Sheet.

STRIPPER SLOT	
SIZE	HRS.
1 x 6	1.0
2 x 6	1.2
3 x 6	1.5
4 x 8	1.8
6 x 10	2.0

FIG. 18

In the punch plate (pad) an opening has to be machined to receive and hold the punch. Consult the fourth column

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of Table 16—size 4" and units 4—and the required time is found to be 1.2 hours. The same time is allowed for machining the slug clearance hole in the die shoe. Enter 1.2 in Column D opposite Punch Plate and again opposite Die Shoe.

There remains only the stripper and Column D will be ready for totaling up. Column 5 in Table 16 gives us .8 of an hour for making the clearance hole for the punch in the stripper. Fig. 18 indicates 1.0 hour for machining the stripper slot, which in our die serves also as a stock gage. Entering these two figures in Column D opposite stripper, one under the other, we add the figures in Column D, thus obtaining a total of 12.6 hours. This would be the total time required for completely machining and finishing all parts so far described. There is more data for Column D to follow in the next chapter and we will then make short order also of columns E and F. Next, having familiarized ourselves thoroughly with the estimating system as a whole, we will begin to estimate a series of average shop dies, first simple ones and gradually more difficult ones until we learn how to apply the time values in the tables correctly.

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Utilization of Rubber

(Continued from Page 18)

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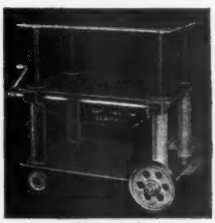

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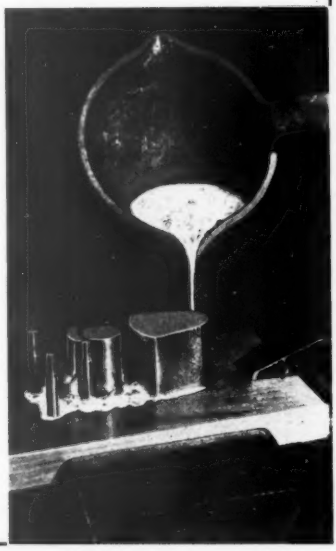

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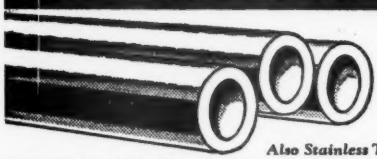

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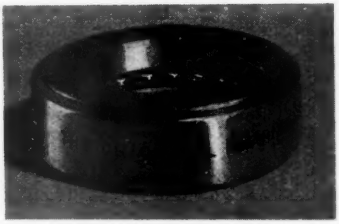

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100% Controlled Tool Steel

(Continued from Page 27)

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The Catalog Review

Brief descriptions of current industrial literature including technical booklets and bulletins, catalogs and circulars. All may be had upon request, without charge. . . . Please use identification numbers.

FIVE TYPES OF DIE SETS—covering practically every need of the die shop are described with full specifications and illustrated by photographs and blue prints in Baumbach Die Sets and Accessories Catalog No. 37. The five types—Advance Line of Semi-Steel Die Sets; Large and Universal Die Sets; Die Sets of Drop Forged Steel; Machined Steel Die Sets and Automatically Oiled Die Sets of Semi-Steel are all treated fully in separate sections as also are Die Shoes and Punch Holders and a complete line of accessories. Price and Dimension Tables of all die sets include prices, telegraphic code of every set, weight and every dimension. The catalog is a handsomely bound, 288-page book printed in two colors. A ready reference index makes it very convenient to use. Please use your business letterhead when you ask for your copy of Catalog No. 37. Write E. A. Baumbach Mfg. Company, 1814 South Kilbourne Avenue, Chicago, Illinois.

HOW TO SELECT TURRET LATHE TOOLS.—Since the total production time for any turret lathe job consists of Set-up Time, Handling Time and Cutting Time, the proper selection of tools is necessary if these three time elements are to be kept in their correct proportion, regardless of the length of runs. Warner & Swasey's Catalog and Manual No. 38 "Turret Lathe Tools" gives valuable suggestions on the selection of turret lathe tools. The catalog and manual is divided in sections on chucking tools, bar tools, cross slide tools, holding devices, semi-standard and special tools. A data section includes, in addition to the regular tables, specification pages of each of the five ram and five saddle type turret lathes in the Warner & Swasey line. Attractively bound in imitation leather, well illustrated by photographs, many of tools in use, drawings and with separate additional sectional indexes, the No. 38 Catalog and Manual is a practical necessity in the tool room which operates one or more turret lathes. The Warner & Swasey Company will send the No. 38 Catalog and Manual to interested shop owners, supervisors or superintendents.

IF IT IS A SQUEEZE RIVETER JOB.—Hanna experience has probably included it or similar work. Catalog 227 "Squeeze Riveters that 'Fit the Job'" is a pictorial story of the great variety of uses to which Hanna Squeeze Riveters are being put. Available in machines for squeezing rivets as small as ⅛" up to 2" and ranging from 2" reach up to 21", the Hanna Squeeze Riveters deliver a long, uniform pressure stroke that automatically exerts the rated tonnage of the riveter on a range of thicknesses of the work being riveted. Operation is very simple—"a twist of the wrist" and the jaws of the riveter close, setting the rivet. The valve automatically reverses ready for the next rivet. Forged yokes of the proper design and size to "fit the job", compactness and perfect balance make the Hanna Squeeze Riveters easy to handle. The catalog gives many excellent application examples. For a copy of catalog 227 write Hanna Engineering Works, 1759 Elston Avenue, Chicago, Illinois.

"A SMALL TOOL ENCYCLOPEDIA"—as one toolmaker called it, the Brown and Sharpe Small Tools Catalog No. 33 is the most complete listing of this manufacturer's machinists and screw machine tools, cutters, hobs, arbors, collets, adaptors and miscellaneous equipment. Tool room and die shop requirements are covered in great detail. The catalog is a convenient size and well

indexed for ready reference. Unusually well illustrated, with prices of all tools indicated and containing many useful tables. No. 33 Small Tool Catalog is equally valuable in buying tools and for general shop reference. For your shop copy write Brown & Sharpe Mfg. Co., Providence, Rhode Island.

"IT'S FILES ON PARADE"—in the Nicholson File Company 64-page catalog. Machinist's files, Swiss Pattern Files and Rifflers, saw files, rasps, tools and specialties are listed with photographs, specifications, weight tables and an alphabetical index. Of special interest to tool room and die shop men are the mill files, flat and half-round, die sinker, bench filing and parallel machine files.

The Nicholson File Company manufactures a very complete line of files with original Swiss designs or patterns —this line is known as the Nicholson X.F. Swiss Pattern Files. The Swiss Files, made in a separate part of the Providence factory, designed and built for the manufacture of these extra fine files. A copy of the catalog as well as of the latest price lists will be sent on request. Write Nicholson File Company, Providence, R. I.

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(Continued from Page 16)

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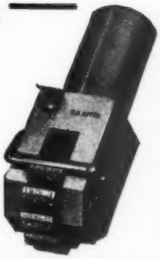

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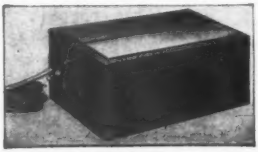

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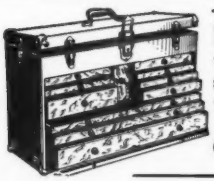

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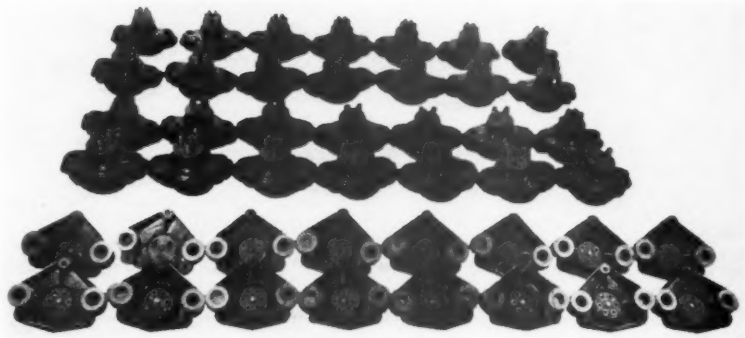

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